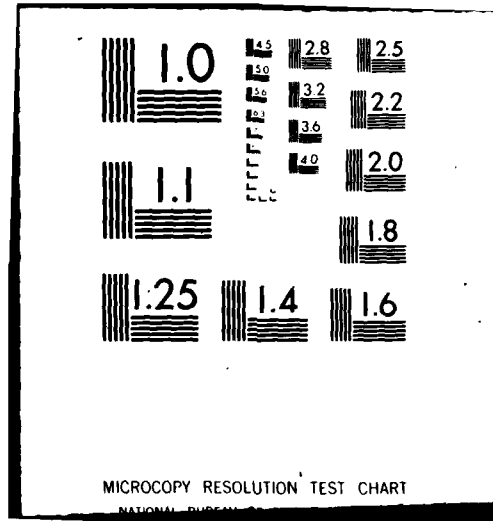


ARMY ARMAMENT MATERIEL READINESS COMMAND ROCK ISLAND --ETC F/G 19/1
FEASIBILITY STUDY: USE OF RELOADED CALIBER .45 M1911 PALL CARTR--ETC(U)
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**FEASIBILITY STUDY: USE OF RELOADED
CALIBER .45 M1911 BALL CARTRIDGES
FOR MILITARY TRAINING
TECHNICAL REPORT**

JANUARY 1982

**PREPARED BY
LOREN F. BRUNTON
GENERAL ENGINEER**



**LOGISTICS ENGINEERING DIRECTORATE
U. S. ARMY ARMAMENT MATERIEL
READINESS COMMAND
ROCK ISLAND, IL 61299**

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) A contract was awarded to a licensed reloader to reload 250,000 government-furnished, once-fired .45 caliber cartridge cases. The reloaded cartridges were subjected to performance, safety, and user evaluations. Simultaneously, the economic practicality of substituting reloaded cartridges for new cartridges was evaluated. Technically, it was found to be feasible to use reloaded cartridges for training purposes, but an Economic Analysis demonstrated that it was cheaper to buy new cartridges which are suitable for both combat and training usage.			

FEASIBILITY STUDY: USE OF RELOADED
CALIBER .45 M1911 BALL CARTRIDGES
FOR MILITARY TRAINING

JANUARY 1982

BY

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TECHNICAL REPORT NO. DRSAR-LE-82-1

Approved by

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BACKGROUND

Defense Audit Service (DAS) Report Number 867 was issued on 13 Mar 78. This report recommended that the Assistant Secretary of Defense "... establish policies that prohibit demilitarization of expended small arms cartridge casings, allow the sale of undemilitarized small arms cartridge casings to licensed ammunition reloaders, and allow the military departments to use reloaded ammunition for training purposes." This evaluation of reloaded Caliber .45 M1911 Ball Cartridges is part of the overall effort to validate and implement the DAS recommendations. Cessation of expended cartridge case demilitarization and the sale of expended, "as is", cartridge cases to licensed reloaders was implemented in Apr 80. Evaluation of reloading expended Caliber .38 M41 Cartridge Cases was conducted and found to be not cost effective. The final report documenting this finding was issued on 7 Aug 81. Evaluation of reloading expended caliber 5.56mm cartridges is ongoing. A draft copy of the final report on this evaluation will be available at a later date.

OBJECTIVE

The objective of this evaluation is to establish:

- a. The technical feasibility of commercially reloading spent .45 Caliber M1911 Cartridge Cases and determined their suitability for troop training.
- b. The economic practicality of using commercially reloaded .45 Caliber M1911 Ball Cartridges for training purposes.

APPROACH

A quantity of 250,000 reloaded cartridges was chosen for this evaluation because it is large enough to verify the adequacy of the reloaded cartridges and has a high enough dollar value to be commercially attractive, yet it's not so large as to preclude bids from small reloading companies. The approach for this evaluation was to have ARRADCOM prepare a scope of work which contained the necessary technical requirements to assure that the reloaded cartridges would meet the minimum required performance level. The scope of work was included in a competitive Invitation for Bid (IFB); and a contract was awarded to the low bidder. 10,000 reloaded .45 caliber cartridges were delivered to ARRADCOM for technical and safety evaluation and 240,000 were delivered to a training base for user evaluation. Simultaneously, the Defense Logistics Agency and TRADOC were consulted concerning the economic factors involved with collecting, transporting, and disposing of the spent cartridge cases.

TECHNICAL EVALUATION

A competitive IFB DAAA09-80-B-0083 was prepared which required reloading and testing of 250,000 caliber .45 cartridges. The Scope of Work contained in this solicitation was prepared by ARRADCOM, DRAAR-SCA-AC.

A copy of the Scope of Work is attached as Appendix A. The expended cases for reloading were furnished by the government.

An article advertising the solicitation was published in the Commerce Business Daily and 23 licensed reloaders were queried concerning their desire to obtain a copy of the solicitation. Six firms requested solicitations and four bids were received. The firms that bid were:

- a. Florida Ammunition Supply Co., Pinellas Park, FL
- b. H & H Cartridge Corp., Greensburg, IN
- c. US Cartridge Co., Mason, MI
- d. Zero Bullet Co., Cullman, AL

The low bidder, Florida Ammunition Supply Co., took extensive exceptions to the terms and conditions of the IFB. Their bid was determined to be legally nonresponsive. A preaward survey was conducted on the next low bidder, Zero Bullet Co. The preaward survey was positive and contract DAAA09-80-C-0111 was awarded to Zero Bullet Co. at a price of \$29,750 or \$0.119 per reloaded cartridge.

The first 10,000 reloaded cartridges were shipped directly to the ARRADCOM Testing Site at Ft. Dix. They were subjected to a series of performance and safety tests. A copy of the ARRADCOM Test Report is at Appendix B.

The report concluded that the reloaded cartridges were safe and suitable for training use. The one problem encountered with these cartridges was poor performance in the mercurous nitrate residual-stress test. During this test, 57 out of the sample of 60 cases split. This test result indicates the reloaded cartridges were under high residual stress and are not suitable for long term storage. This problem could be substantially reduced by requiring cartridge case stress-relief prior to reloading and tumble peening (tumbling) of the reloaded cartridges prior to packaging.

Based upon these test results, an Interim Safety Statement was prepared for these reloaded .45 caliber cartridges. A copy of this statement is at Appendix C. This Safety Statement was required before using troops could be allowed to fire the reloaded cartridges.

Zero Bullet Co. reloaded the remaining 240,000 cartridges and shipped them to Ft. McClellan. Ft. McClellan was chosen as the firing evaluation site because it's the largest Army user of caliber .45 ammunition. The ARRADCOM safety statement was forwarded through HQ, TRADOC to Ft. McClellan. Once the safety statement was received at Ft. McClellan, user evaluation commenced. The evaluation ran from Jan through Jun 81. User evaluation of the reloaded cartridges was successful. Of the 240,000 reloaded rounds fired, only one bullet-in-bore misfire was encountered, and 10 rounds had the projectile misaligned which caused feed malfunctions.

ECONOMIC EVALUATION

Prior to the cession of spent cartridge case demilitarization, spent cartridges could only be sold as scrap brass for around \$.30 per pound. After case demilitarization cession in Apr 80, spent cartridge cases are sold at the local level on an "as is" basis to licensed reloaders. Spent .45 caliber cartridge cases are currently selling for an average price of \$2.50 per pound. This data, together with other pertinent economic data, was thoroughly evaluated in the "Economic Analysis for Cartridge, Caliber .45, M1911: Cost Matrix for Reloaded vs New Cartridges." The Economic Analysis is attached as Appendix D. The adequacy of this Economic Analysis has been validated by the ARRCOM Controller Cost Analysis Office at validation level II.

CONCLUSIONS

a. Technical: This evaluation demonstrated that it is technically feasible to have spent .45 caliber cartridge cases commercially reloaded to government specifications and that the reloaded M1911 Cartridges are suitable for training usage. However, if reloading of spent cases was pursued, the Scope of Work would have to be modified to include a requirement for stress relieving the cases after resizing and prior to reloading and a requirement to tumble the reloaded cartridges prior to packaging.

b. Economic: The Economic Analysis attached at Appendix D clearly demonstrates that it is not cost effective for the Army to reload spent .45 caliber cartridge cases for training use, i.e., it costs less to buy new .45 Caliber M1911 Cartridges at \$0.08929 per cartridge which are suitable for both combat and training usage than it costs to reload spent cases at \$0.11951 per cartridge, which is suitable for training use only.

RECOMMENDATIONS

The reloading of expended Caliber .45 M1911 Cartridge Cases not be pursued further and that the DAS recommendation concerning the reload and usage of these cartridges should not be implemented, i.e., only new Caliber .45 M1911 Ball Cartridges, suitable for both combat and training should be procured.

APPENDICES

Appendix A - Scope of Work

Appendix B - ARRADCOM Letter Test Report

Appendix C - Interim Safety Statement for Cal. .45 Reloaded Cartridge
Cases

Appendix D - Validated Economic Analysis

Appendix A

3 Mar 80

SCOPE OF WORK

1. OBJECTIVE: To procure 250,000 rds. of Cal. .45 Automatic Cartridges with reloaded cases.

2. PROCEDURES:

- 2.1 The contractor will furnish to the government 250,000 rounds of reloaded Cal. .45 Automatic Cartridges that meet the performance and quality levels as specified in the attached "Performance and Quality Requirements for Reloaded Cal. .45 Automatic Cartridges" (Incl 1).
- 2.2 The contractor will sort, inspect, clean and rework Cal. .45 Automatic cases furnished by the government in sufficient quantities to meet delivery requirements of paragraph 2.1.
- 2.3 The contractor will resize and trim the cases according to established reloading practices, and reload the cases to meet the requested performance requirements.
- 2.4 The contractor will conduct sufficient testing and inspection to insure that the stated performance and quality requirements are met and will furnish results of such testing to the government.
- 2.5 The rounds shall be packed according to drawings: 7553728, 7553729 and 5580944, except markings shall be "Reloaded Cartridge Cal. .45 Automatic Ball".
M2A1 ammunition cans will be furnished by the government.

3. DOCUMENTATION:

- 3.1 The contractor will certify that the quantity of ammunition meets the stated requirements, and will provide to the government the results of testing to substantiate such certification.
- 3.2 The contractor will provide a cost estimate for similar quantity of ammunition except packing shall conform to commercial standards.

3 Mar 80

4. GOVERNMENT FURNISHED MATERIAL (GFM):

- 4.1 350,000 fired Cal. .45 Automatic cartridge cases.
- 4.2 250 M2A1 ammunition cans

5. SHIPPING INSTRUCTIONS:

- 5.1 10,000 rounds will be shipped to Transportation Officer, US Army ARRADCOM Test Site, Ft. Dix, NJ 08640.
- 5.2 Shipping instructions for the remaining quantity will be furnished at a later date by the PCO.

9 MAR 1980

PERFORMANCE AND QUALITY REQUIREMENTS FOR
RELOADED CALIBER .45 AUTOMATIC CARTRIDGES

CARTRIDGE: Caliber .45 Automatic

BULLET: Drawing 11731786 or commercial equivalent (full jacket 234-6 grains).

CASE: Previously fired Cal. .45 Automatic case, resized, length shall not exceed 0.898".

PRIMER: OLIN 111,
REMMINGTON 73
FEDERAL 150

PROPELLANT: Hercules Bullseye, charge to suit ballistics.

VELOCITY: * The average velocity of a 50 round sample shall be 855 ft/sec plus or minus 35 ft/sec. The standard deviation of the velocity shall not exceed 27 ft/sec. The velocity shall be measured at a distance of 25 ft from the muzzle.

PRESSURE:* The average chamber pressure of a 50 round sample shall not exceed 19,000 psi.

ACCURACY:* The average of the diagonals of 9 targets of 10 rounds each fired at 50 yards shall not exceed 7.46".

BULLET EXTRACTION: The minimum bullet extraction force in a sample of 20 rounds shall exceed 40 lbs.

* Test equipment and procedures shall be as specified in MIL-C-1311 and Small Caliber Ammunition Test Procedures SCATP-45, or by the Sporting Arms and Ammunition Manufacturers' Institute (SAAMI).

FUNCTION AND CASUALTY: The cartridges are required to function without casualty at ambient temperature. Acceptance of the lot with respect to function and casualty will be based on Table I, and the attached drawing 7643674, Classification of Defects, after firing 588 rounds in each of two Colt Government Model Mark IV/Series 70 Automatic Pistols. The cumulative number of firing defects from the function and casualty testing as well as defects from other firing tests shall not exceed the number of defects allowed in Table I.

3 MAR 1980

VISUAL AND DIMENSIONAL QUALITY:

Visual and dimensional defects are those as specified in the Classification of Defects, Table II. One hundred percent examination shall be performed for all critical defects. Examination for major and minor defects shall be performed on a class basis in accordance with Table II. This should be accomplished using either applicable sampling plans and acceptance criteria of MIL-STD-105D or the manufacturer's usual practice for controlling quality during production, provided the manufacturer documents his Quality Assurance procedures and submits them to the government for approval. The acceptance quality level (AQL) for the major class shall be 0.25%, and AQL for the minor class shall be 1.50%.

3 MAR 1980

Table I

Defects	accept number	reject number
Misfire <u>1/</u>		
a. No vent hole, or obstruction in vent area	0	1
b. Other	1	2
Bullet remaining in bore <u>2/</u>	0	1
Primer leak		
a. Perforation in firing pin indent in primer cup	1	2
b. escape of gas around primer cup <u>3/</u>	14	15
c. Primer remains in pocket, but is physically loose	2	3
d. Blown primer	0	1
e. Primer falls out of pocket on retraction of bolt	0	1
Case casualty		
a. Longitudinal split <u>4/</u>		
(1) Mouth (I)	27	28
(2) Body (J)	7	7
(3) Body (K)	1	2
(4) To head (L)	0	1
(5) Through head (M)	0	1
b. Circumferential rupture <u>4/</u>		
(1) Partial (J)	6	7
(2) Partial body (K)	0	1
(3) Partial head (L)	0	1
(4) Complete	0	1
Failure to extract	0	1
Weapon stoppage <u>5/</u>	0	1

1/ Each cartridge that misfires shall be disassembled and examined for presence of vent hole in the primer pocket, or any obstruction in the vent hole area of the primer pocket that can be assignable as the cause for misfire. If the vent hole is missing or obstructed, the lot shall be rejected with no second sample permitted.

2/ No second sample permitted. Lot shall be rejected.

3/ Gas escapes around more than fifty percent of periphery of cup.

4/ For location of defects indicated by letters in parenthesis, see drawing C7643674.

5/ All stoppages attributable to the ammunition, with the exception of misfire, complete rupture or failure to extract, observed in all tests shall be included.

Table II

8 MAR 1980

No.	Defect and Method of Inspection	Critical	Major	Minor	Major or Minor
<u>Cartridge</u>					
1	Discolored, dirty, oily, smeared			x	
2	Corroded; or stained if etched		x		
<u>Case</u>					
3	Round head			x	
4	Dent				x
5	Split case				
	in K, L, or M location	x			
	in I, S, or J location		x		
6	Perforated	x			
7	Scratch			x	
8	Scaly metal				x
9	No chamfer on head (rim)			x	
10	Wrinkle			x	
11	Bulge			x	
12	Defective head			x	
13	Defective mouth			x	
<u>Bullet</u>					
14	Dent			x	
15	Scratch			x	
16	Split bullet jacket		x		
17	Loose bullet		x		
18	Scaly metal				x
19	Upset (crooked) point			x	
20	Exposed steel (clad jacket)			x	
21	Flat point			x	
<u>Primer</u>					
22	No primer	x			
23	Cocked primer	x			
24	Inverted primer	x			
25	Loose primer		x		
26	Nicked or dented primer			x	
27	Primer above flush		x		

Appendix B



DEPARTMENT OF THE ARMY Mr. Cramer/prc/AUTOVON
US ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND 880-2917
DOVER, NEW JERSEY 07801

DEC 12 1980

DRDAR-SCA-AP

SUBJECT: Cartridge Case Reload of Caliber .45 Rounds

Commander
US Army Armament Materiel Readiness Command
ATTN: DRSAR-LEW, Mr. Brunton
Rock Island, IL 61299

1. Reference:

a. Letter, DRSAR-LE, HQ, ARRCOM, 22 Jan 80, subject: Cartridge Case Reload of Caliber .38 and .45 Rounds.

b. Letter, DRDAR-SCA-AC, HQ, ARRADCOM, 22 Feb 80, subject as above.

2. Reference 1a cited the need to expand the Army's efforts to realize cost savings through the reuse of previously fired cartridge cases in the manufacture of small-caliber ammunition and requested ARRADCOM assistance in procuring and assessing commercially reloaded Cal. .38 and .45 cartridges. In reference 1b, ARRADCOM provided a scope-of-work outlining an acceptable reloading process and a Minimum Performance Requirement Document (MPRD) - a quasi specification to which the reloader should certify compliance.

3. ARRCOM provided a 10,000 round sample of commercially reloaded Cal. .45 ammunition and requested that ARRADCOM perform tests and inspections appropriate to certify safety and suitability for issue.

4. To comply with this request, ARRADCOM augmented the MPRD by increasing sample sizes, adding weapon types to the function and casualty test, conducting tests at temperature extremes and adding tests, measurements and inspections for residual stress, cartridge-case hardness, watertightness and propellant-charge level. The tests and results are described in detail in inclosure 1.

5. The ammunition was satisfactory in all respects except that the ambient velocity was slightly high and most of the cartridge cases tested split in the mercurous nitrate test. Neither of these deficiencies is considered serious enough to impede the usefulness of the ammunition which is,

DRDAR-SCA-AP

SUBJECT: Cartridge Case Reload of Caliber .45 Rounds

therefore, considered safe and suitable for training use per Incl 2.

6. ARRADCOM's judgement on the safety and suitability of the test ammunition must be tempered by the following considerations:

a. The test sample was not randomly drawn from the entire production quantity but was taken from the start of production. Since ARRADCOM's test results cannot apply to the balance of the order produced subsequent to the 10,000 round sample, ARRADCOM's test should be likened to an Initial Production Test and the contractor should certify that the remainder has been tested in accordance with and meets the requirements of the MPRD.

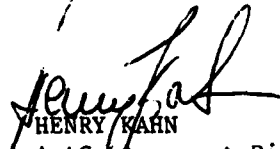
b. The poor performance in the residual-stress test indicates that the cartridge cases are under high stress imparted either by the previous firing or the reloading operation. Because of this condition, long-term storage of the reloaded ammunition is contra-indicated.

c. Since the cartridge cases included in the test have only been reloaded once, no judgement can be made a priori about future procurements of reloaded ammunition which may contain cartridge cases reloaded more than once.

7. The ARRADCOM POC on reloaded handgun ammunition is Mr. William Cramer, AUTOVON 880-2917.

FOR THE COMMANDER:

2 Incl
as


HENRY KAHN
ActC, Armament Division
FC&SCWSL

SUMMARY - TEST DATA

RELOADED CAL .45 CARTRIDGES

VELOCITY-CHAMBER PRESSURE

MIL-C-1311E @70°F

AVG. VEL. 855 F/S ± 25 F/S

STD. DEV. 27 F/S

AVG. PRES. 19000 psi MAX.

MIN. PERFORM. REQM'T @ 70°F

AVG. VEL. 855 F/S ± 35 F/S

STD. DEV. 27 F/S

AVG. PRES. 19,000 psi MAX.

<u>TEMP. +70°F</u>	<u>AVG VEL F/S</u>	<u>AVG PRES PSI (COPPER)</u>	<u>AVG VEL STD DEV</u>	<u>SAMPLE SIZE</u>
REF - LOT WCC-301	816	14100	11	20
ZERO 80S001-117A	895	16700	9	40
<u>TEMP. -40°F</u>				
REF - WCC-301	830	14800	15	20
ZERO 80S001-117A	845	15500	16	40
<u>TEMP. +125°F</u>				
ZERO 80S001-117A	928	17900	11	40

<u>TEMP +70°F</u>	<u>AVG VEL F/S</u>	<u>AVG PRES psi (PIEZO)</u>	<u>AVG VEL STD DEV</u>	<u>SAMPLE SIZE</u>
REF - WCC-301	846	16460	13	20
ZERO 80S001-117A	901	18200	9	40

FUNCTION & CASUALTY

<u>TEMP. 70°F</u>	<u>NUMBER OF CTGS</u>	<u>BULGE CASE</u>	<u>SPLIT CASE</u>
PISTOL 1312680 (O.B.)*	294	0	0
PISTOL 1511273 (O.B.)	294	0	0
Sub-MACH-GUN M3A1	900	0	1
PISTOL 1312680 (M.B.)**	294	1	1
PISTOL 1511273 (M.B.)	294	0	0
 <u>TEMP. +125°F</u>			
PISTOL 1312680 (O.B.)	147	0	0
PISTOL 1511273 (O.B.)	147	0	0
PISTOL 1312680 (N.B.)***	147	0	0
PISTOL 1511273 (N.B.)	147	0	0
 <u>TEMP. -40°F</u>			
PISTOL 1312680 (O.B.)	147	0	0
PISTOL 1511273 (O.B.)	147	1	0
PISTOL 1312680 (N.B.)	147	0	0
PISTOL 1511273 (N.B.)	147	0	0

- * OLD BARREL
- ** MEDIUM BARREL
- *** NEW BARREL

ACCURACY TEST

MEAN DIAGONAL (18 TARGETS) 5.2 INCHES

SPEC.
7.46 MAX

BULLET PULL (1bs)

AVG OF 100 CTGS - 178# STD DEV 45.3

40# MIN

AVG POWDER WGT

AVG OF 100 CTGS - 5.57 GRAINS

WATERPROOFNESS

SAMPLE
SIZE

NON
LEAK

SLOW
LEAK

FAST
LEAK

60

49

9

2

MERCUROUS NITRATE

SAMPLE
SIZE

NUMBER OF
SPLITS

60

57

Appendix C

TITLE: INTERIM SAFETY STATEMENT
FOR CAL. .45 RELOADED
CARTRIDGE CASES

INSTALLATION: ARRADCOM
Dover, NJ

DATE: 09 December 1980

1. Introduction

a. Purpose. The purpose of this safety statement is:

1) To provide a safety evaluation of 10,000 rounds of reloaded .45 caliber ammunition.

2) To note any hazards that may be encountered at Ft. McClellan during troop testing of 240,000 rounds of .45 caliber ammunition reloaded by the same manufacturer.

b. This statement was prepared in accordance with AMCR-385-12.

2. System Description

a. Purpose and Intended Use. The purpose of case reloading is to save on material, manufacturing, and demilitarization costs. Reloaded ammunition is intended for use in training situations only.

b. Background. In March of 1978, the Defense Audit Service (DAS) published a report on Demilitarization of Expended Small Arms Cartridge Cases in DOD. Specific Recommendations of that audit were as follows:

1) Stop demilitarization of fired small caliber residue and sell as reloadable cartridge cases.

2) Buy reloaded ammunition for training.

3) Establish in-house reloading capability.

As a result, a DOD directive (5160.65) was issued stating that maximum savings should be achieved through reloading spent cartridge cases and that the Military Service use reloaded ammunition, as appropriate, for training purposes.

As a result of the above directive, ARRCUM and ARRADCUM are conducting studies to implement the recommendations of DAS. With regard to the DAS recommendation to buy reloaded ammunition for training, a Scope of Work was prepared for Zero Ammunition Co. Inc. of Cullman, Alabama stating instructions and requirements for the reloading of 250 K .45 caliber cartridge cases. The first 10 K cases reloaded (evaluated in this safety statement) were shipped to the ARRADCUM Test Site at Ft. Dix, NJ, and approximately 3,400 of them have been fired there. The rest were shipped to ARRADCUM in Dover, NJ for further testing. The remaining 240 K will be shipped to Ft. Mc Clellen for user evaluation.

c. Item Description. The cases are standard, .45 caliber, brass cartridge cases of mixed brand and age. Most of the manufacturing dates range from 1961 to 1979 with a high concentration of cases manufactured in '77 and '79. The cases were loaded and fired only once before.

The SOW requires the cases to have been sorted by caliber, inspected for damage, cleaned, and reworked. The cases were to be resized and trimmed according to established reloading practices and reloaded to meet specific Performance and Quality Requirements specified in the SOW.

d. Test Weapons Used. The rounds tested at Ft. Dix were fired from: test barrels (at -40, 70, and 125°F), pistols M1911A1 with new and used barrels, and an M3 Sub Machine Gun.

3. System Operation. The operational sequence for firing is no different from standard .45 caliber, center fired ammunition. A firing pin initiates the center fired percussion primer and the explosive output is propagated through the vent hole into the propellant charge. The explosive gas pressure from the initiation of the propellant ejects the bullet from the cartridge case and produces an acceleration force moving the bullet through the barrel.

4. Safety Engineering.

a. Testing. A total of 3,400 rounds have been ballistically tested at the ARRADCUM Test Site and Ft. Dix, NJ. In addition, water proofness, residual stress, bullet extraction, cartridge case hardness, and propellant weight testing was done. 7,340 of the 10,000 were visually inspected for proper priming and case defects. 7,340 were checked for proper propellant level either by firing, isotopic gaging, or propellant weight measurement.

Of the 3,400 cartridges used for ballistic tests, two had bulges large enough that they couldn't be chambered and two cases had splits (J-split) after firing. The tests conducted at the ARRADCOM Test Site were fired without hazardous or safety problems for personnel, equipment, or property reported.

The Mercurous Nitrate Test was conducted on (60) cartridge cases to determine if stresses exist that may cause them to crack or split when exposed to a corrosive atmosphere. The results of this test, 57 mouth splits of 60 cases tested, indicates that the side wall of the cases were under stress. This may be the result of previous loading, firing, or the reloading operation. Had the cartridges not been exposed to a corrosive atmosphere the cracking would not have occurred. However, exposure to mercurous nitrate or ammonia (corrosive environment) relieves the stress, resulting in intergranular splits. The extent of splitting is subject to the following conditions:

- (1) Concentration of the corrosive atmosphere.
- (2) Degree of the stress.
- (3) Time of exposure to corrosive atmosphere.

b. The hazard classification data for the M1911, Cal. 45, Ball, Cartridge is as follows:

DOD Hazard Classification	1.4
DOD Storage Compatability Group	S
DOT Hazard Classification	C
DOT Container Marking	"Small Arms Ammunition"

5. Conclusions and Recommendations.

Based on the results of ARRADCOM testing at Ft. Dix and Dover, NJ, and the test and inspection information furnished by the manufacturer, no safety problems are expected. The 240 K rounds of ammunition are considered safe to fire with the following precautions:

a. Since the mercurous nitrate test showed the cases to be under stress, precautions should be taken to lessen the possibility of the cases deteriorating with time. It is recommended that the ammunition be expended as soon as is feasible and that it be stored in a benign environment (e.g. ammo cans). All splits observed (57 - Stress Test and 2 - Functioning) were mouth splits in the I or J location. Splits in this region are not considered to be a safety problem.

b. The performance of reloaded ammunition has not yet been proven to equal that of new ammunition. For this reason, reloaded ammunition is intended for training purposes only. The user must be careful not to mix this ammunition with new ammunition since the reloaded rounds do not bear any distinctive marking and because of a. above.

c. Standard procedures for hearing protection must be followed.



HUGH F. LAZAR
Actg. Dir. Product Assurance

Concurrence:


DRDAR-SCA-AP *wf*

Approval:


ROBERT A. WALTERSCHIED
Chief, Safety Office *SEE*

Appendix D

ECONOMIC ANALYSIS

Cartridge, Caliber .45, M1911. Cost Matrix for

Reloaded vs New Cartridges

This matrix compares the cost elements for reloading and for new manufacture of cartridges, caliber .45, M1911. The individual cost elements are shown in FY 80 dollars and are on a per million cartridge basis.

<u>Cost Element</u>	<u>Reload</u>	<u>New</u>
1. User Installations Collect Fired Cartridge Cases.	\$ 455.60	\$ 455.60
2. Ship Expended Cartridge Cases to Anniston Army Depot (ANAD).	1,088.00	N.A.
3. Storage and Handling Costs at ANAD.	272.00	N.A.
4. Shipment of Expended Cases from ANAD to Reloading Plant.	1,088.00	N.A.
5. Reloaded and New Cartridge Production Costs.	119,000.00	150,651.00
6. Sale of Expended Cartridge Cases (negative factor).	-2,389.09	-61,818.18
Total Costs Per Million Cartridges:	\$119,514.51	\$ 89,288.42
Therefore, the Cost Per Individual Cartridge is:	\$ 0.11951	\$ 0.08929

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RATIONALE

Cost Element Breakdown for One Million Cartridges,

Reloaded or New - 1980 Cost Baseline

A. Cost Element 1 - User Installations Collect Fired Cartridge Cases: This cost element applies to both reloaded and new cartridges. For reloaded cartridges, the expended cases would be required for reloading. For new cartridges, the expended cases would be collected and sold "as is." The TRADOC furnished average user cost for collecting 1,000,000 expended cases is \$335.00. Based upon the caliber .38 PGU-12 reloading at Lake City Army Ammunition Plant, 1,360,000 "as is" expended cases were required to achieve 1,000,000 reloaded cartridges. This translates into a scrap factor of $1,360,000 \div 1,000,000$ or a 1.36 scrap factor. Applying the scrap factor, this cost element is:

1. Reloaded Cartridge: \$335.00 per million cases collected X 1.36 scrap factor = \$455.60.

2. New Cartridges: \$335.00 per million cases collected X 1.36 scrap factor = \$455.60.

B. Cost Element 2 - Ship Expended Cartridge Cases to Anniston Army Depot (ANAD): This cost element applies to reloaded cartridges only. For new cartridges, the expended cases would be sold locally. ANAD was chosen as the collection point because it is the closest depot to Ft. McClellan, which is the largest user of .45 caliber cartridges. The TRADOC furnished average user cost for shipping 1,000,000 expended cases to ANAD is \$800.00. The 1.36 scrap factor applies to this cost element. This cost element is:

1. Reloaded Cartridges: \$800.00 per million cases shipped X 1.36 scrap factor = \$1,088.00.

2. New Cartridges: N.A.

C. Cost Element 3 - Storage and Handling Costs at ANAD: This cost element applies to reloaded cartridges only. For new cartridges, the expended cases would be sold locally. The estimated cost for storing and handling one million expended cases at ANAD is \$200. The 1.36 scrap factor applies to this cost element. This cost element is:

1. Reloaded Cartridges: \$200 per million cases stored and handled X 1.36 scrap factor = \$272.00.

2. New Cartridges: N. A.

D. Cost Element 4 - Shipment of Expended Cases from ANAD to Reloading Plant: This cost element applies to reloaded cartridges only. For new

cartridges, the expended cases would be sold locally. The shipping costs for this cost element are estimated to be equal to Cost Element 2, i.e., \$800.00 per million cases. The 1.36 scrap factor applies to this cost element. This cost element is:

1. Reloaded Cartridges: \$800.00 per million cases shipped X 1.36 scrap factor = \$272.00

2. New Cartridges: N.A.

E. Cost Element 5 - Reloaded and New Cartridge Production Costs: The production cost for reloaded cartridges is the price paid to Zero Ammunition Co. on contract DAAF-09-80-C-0111. This cost per reloaded cartridge was \$0.119 each. The production cost for new cartridges is the price paid to Olin Corp. on contract DAAF-09-80-C-0088. This cost per new cartridge was \$0.150651 each. This cost element therefore is:

1. Reloaded Cartridges: One million cartridges X \$0.119 per reloaded cartridge = \$119,000.

2. New Cartridges: One million cartridges X \$0.150651 per new cartridge = \$150,651.00.

F. Cost Element 6 - Sale of Expended Cartridge Cases: For reloaded cartridges, this element arises from the sale of scrap cases as scrap brass. The scrap cases are those that are sorted out as unsuitable for reloading. Based upon the scrap factor used in Cost Element 1, there would be 360,000 unusable scrap cases for each one million cartridges reloaded. Scrap brass sells for approximately \$0.365 per pound, and there are 55 caliber .45 cases in a pound. The funds obtained from sale of the scrap brass cases would reduce the overall cost of reloaded cartridges, therefore, this factor is shown as a negative cost element. For new cartridges, this element results from the local level sale of expended cases on an "as is" basis to licensed reloaders. The average sale price for these "as is" expended cases is \$2.50 per pound and there are 55 cases per pound. The funds obtained from sale of these cases would reduce the overall cost of new cartridges, therefore, this factor is shown as a negative cost element. This negative cost element is therefore:

1. For Reloaded Cartridges: 360,000 scrap cases ÷ 55 cases per pound X \$0.365 per pound of scrap brass = minus \$2,389.09.

2. For New Cartridges: 1,360,000 "as is" cases ÷ 55 cases per pound X \$2.50 per pound of cases = minus \$61,818.18.

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